



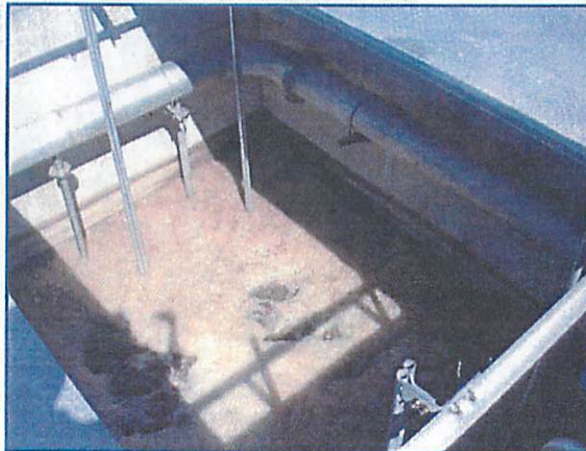
Headworks Building (grit removal, secondary screening, anoxic basins)

### What is MBR?

The MBR process is similar to other biological treatment processes with a few distinct differences. Like other treatment plants, the MBR uses microscopic organisms to treat the wastewater. In typical treatment plants, the organisms are separated from the water using gravity in large tanks. In an MBR, the membranes filter the biological mixture, keeping the organisms in the process and allowing water to flow through the membrane. This has a distinct advantage because more organisms can be used in the process, 3 to 5 times more than in a conventional treatment plant. The result is the ability to treat the same amount of wastewater in a smaller space. Given the valuable land at the Business Park, this was an important consideration for the Tulalip Tribes.

The MBR treatment plant has also been designed to significantly reduce nitrogen in the effluent. This is accomplished by creating anoxic basins in front of the MBR and recycling the biological and wastewater mixture. This allows different types of organisms to convert nitrogen from various forms to a gas which is released harmlessly to the atmosphere.

The membranes are an effective means of disinfection. The extremely small pore size in the membranes does not allow most bacteria to escape the process. Backup disinfection has been installed for water that will be reclaimed to the environment, and chlorine is added to the portion that may come in contact with humans. These measures are taken to ensure that both aquatic life and humans are protected from harmful organisms in the reclaimed water.



MBR Basin - aerobic zone



## Membrane Wastewater Treatment Facility



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*The Tulalip Tribes had a goal* to develop a large tract of land (2,000 acres) adjacent to I-5 into a Business Park for the economic diversification and well being of its tribal members. However, the land could not be fully developed due to lack of utility service - primarily wastewater treatment and disposal.

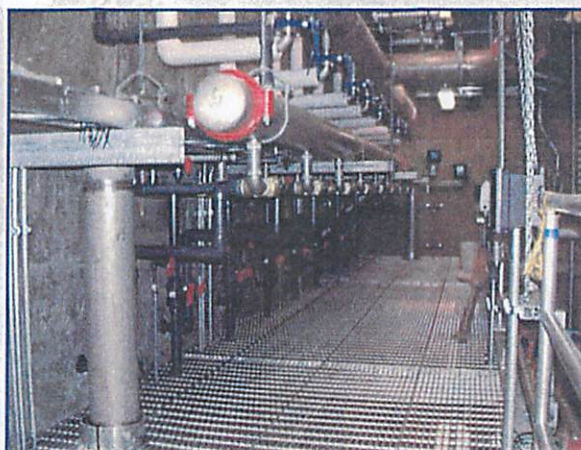
In June of 2001 the Tulalip Tribes became aware of a new technology that might be a solution to provide wastewater service to the Business Park and new casino. The new technology was a Membrane Bioreactor (MBR) wastewater treatment plant using flat plate membranes, developed in Japan by Kubota and used in Japan and the United Kingdom (UK).

Tribal officials, Parametrix engineers, and Treatment Equipment Company representatives traveled to the UK and Ireland and witnessed the MBR technology treating high-strength wastewater to **class A reclaimed water standards**. The technology was also simple to maintain and operate, which was critical to the Tribes.

Installation of the Kubota Membranes in the MBR Basin



In June of 2003, only 24 months after the trip to the UK, the Tulalip Tribes' MBR plant was substantially complete and was placed on-line. The wastewater treatment plant had to be put on-line the same day as the opening of the new casino. If the plant did not perform as planned, the doors of the casino would have been shut. The technology performed as planned and is currently serving the needs of the Tulalip Tribes' Business Park and new casino.



MBR Pipe Gallery - permeate and air piping

At the time of construction, the treatment plant was the largest (future expansion to 4 million gallons per day) MBR flat plate plant in the Americas, and all of the treated effluent is being disposed of using subsurface infiltration within the boundary of the Business Park.



Before (right) and after (left) the membrane

Anticipated future use of the reclaimed water could include:

- *Flushing toilets inside the Business Park buildings.*
- *Irrigation around the Business Park.*
- *Streamflow augmentation to support aquatic life within streams in and surrounding the Business Park.*
- *Cooling water for future cogeneration electric power facilities.*
- *Other reuse/reclaimed water applications.*

There are so many uses currently identified by tribal staff and officials that there may not be enough effluent from the plant to serve all of the reuse/ reclaimed water needs.

Utilities Manager  
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The Consolidated Borough of  
**Quil Ceda Village**

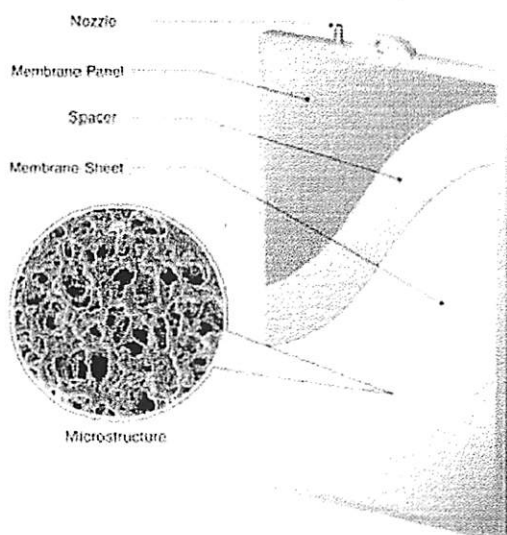
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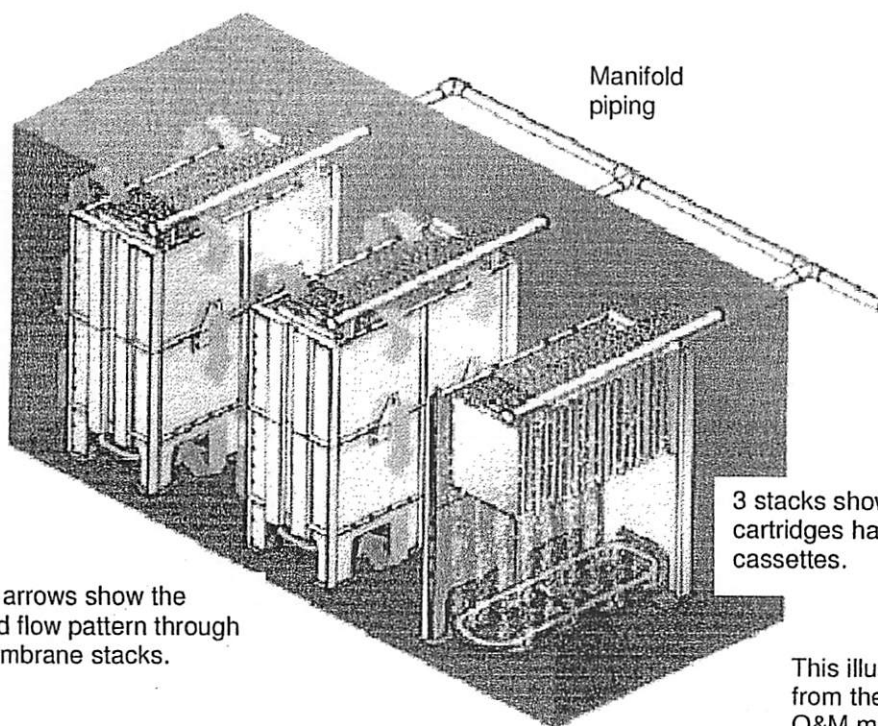


The membranes are built like thin, double-pane windows, approximately 2' x 4', and they hang vertically inside the tanks in racks called "cassettes". They are completely submerged in the mixed liquor, and 1/8" tubes lead from the hollow space between the "panes" of each "window".



The illustration at left was taken from the Enviroquip O&M manual.

These tubes are connected to a 2" manifold for each cassette, and the manifold piping penetrates through the wall of the MBR tank.



Yellow arrows show the induced flow pattern through the membrane stacks.

This illustration taken from the Enviroquip O&M manual